Part 3

OR Department

HYBRID OR

- The term integrative approach in an OR is defined as a room in which all the different equipment is designed to work together in harmony, thus providing increased efficiency and better patient care.
- Hybrid is defined as a room serving both diagnostic a in the same location.

A HYBRID OR

- A traditional OR is approximately 600 to 700 square feet
- New hybrid rooms often are a minimum of 1,000 square feet, in addition to the space used as an equipment room and control room.
- Taking into account these separate rooms, the typical size is 1,200 square feet.

A HYBRID OR

- Hybrid ORs also must accommodate two teams of clinicians, bridging two separate disciplines, resulting in as many as 26 people in the room at one time.
- In addition to being nearly double the size of typical ORs, hybrid ORs use more utilities, require shielding for the radiology equipment, and need structural support for the large equipment booms.

Pre- and Postoperative Patient Care Areas

Preoperative patient care areas and Phase I and Phase II recovery areas = **unrestricted areas.** Individuals in these areas:

- **May wear street clothes**
- **Do not need to cover their hair**
- **No strict ventilation requirements**

Pre- and Postoperative Patient Care Areas

- **The number of Phase I** (**PACU** = post-anesthetic care unit) **patient care stations** required in both inpatient and outpatient settings has been defined as **1.5 per OR.**
- If that calculation yields a fraction, the number of patient care stations provided is to be rounded up to the next whole number.
- A patient care station can be a single-patient room or a bay or cubicle in a room with spaces for multiple patients.

Pre- and Postoperative Patient Care Areas

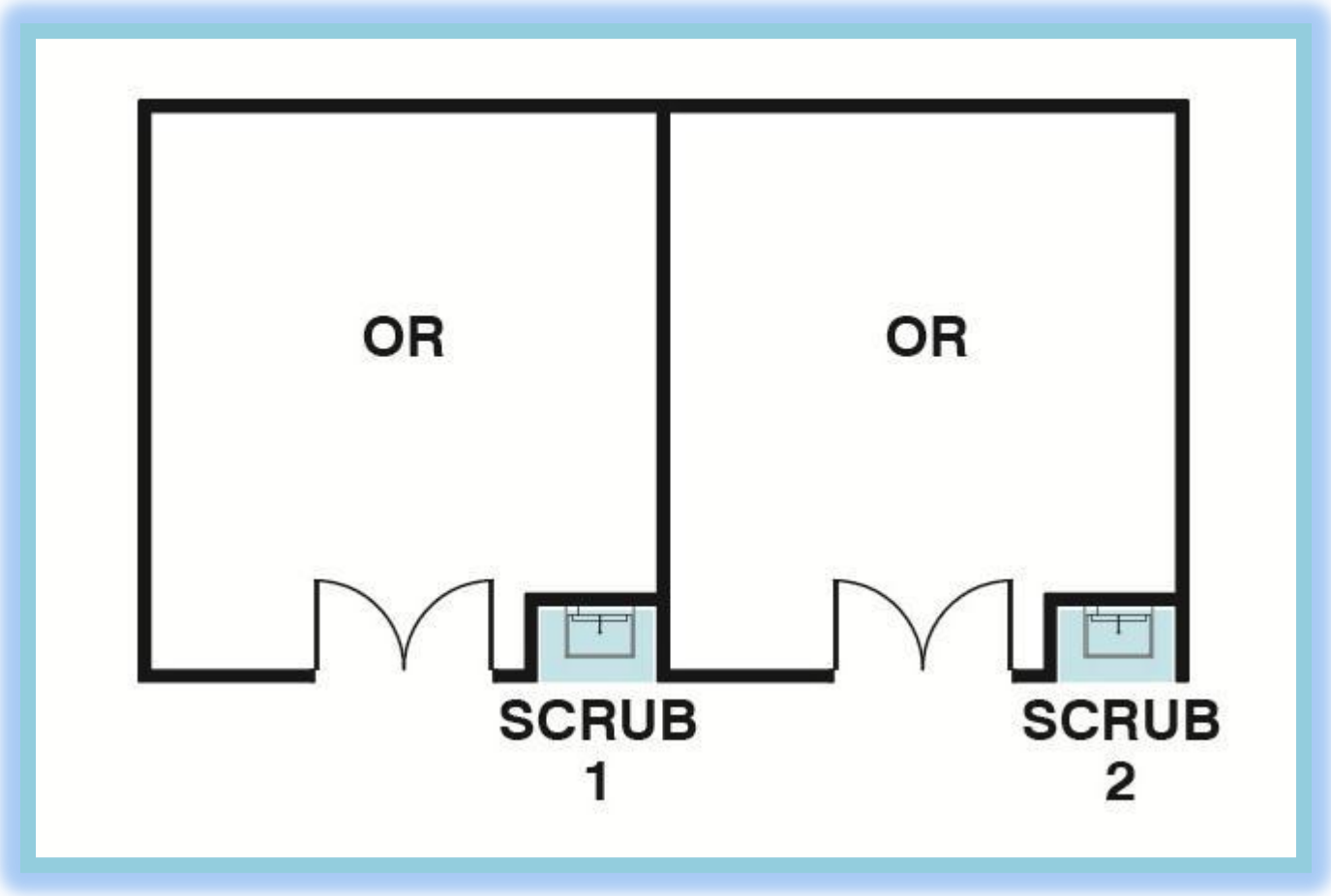
- **The location for hand-washing stations** in preoperative and recovery areas with multiple patient care stations in the same room (i.e., not private patient care rooms) is now consistent in ambulatory and hospital surgery facilities.
- **One hand-washing station for every four patient care stations.**
- The hand-washing stations must be evenly distributed so the distance from the two patient care stations farthest from a hand-washing station is approximately equal.

Support Areas for Surgical Facilities

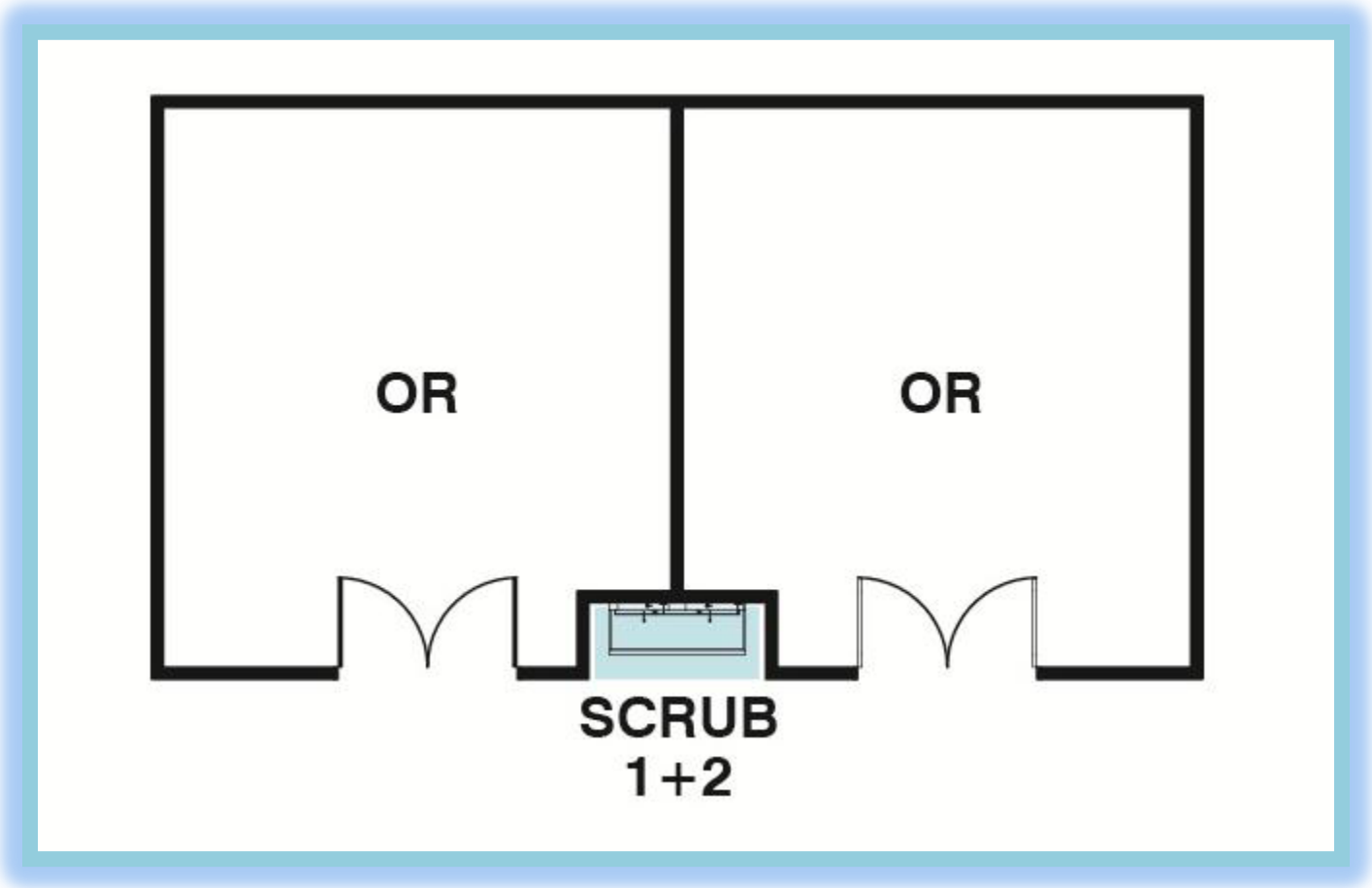
The location for scrub sinks and the number of sinks required:

- At least one scrub position must be located next to the entrance of each operating room.
- A scrub station with two scrub positions may serve a pair of operating rooms as long as it is located next to the entrance to each OR.
- Scrub stations are not permitted to impede on the width of the corridor.
- Avoiding splatter from the sinks.

Scrub Station Location Options



Scrub Station Location Options



Support Areas for Surgical Facilities

- The following support area requirements have been removed from both the ambulatory and the hospital surgical facilities text:
  - A “substerile” room between every two operating rooms.

Support Areas for Surgical Facilities

- The need for the door to the staff locker room to open directly into the semi-restricted area of the surgical suite **has been removed**.
- The current requirement: only a locker room must be provided.
- A locker room to be shared with another department.
- The same is true for the lounge used by the perioperative team.

Design of the Operating Department

►The physical features of operating departments, some widely accepted principles:

- Clean uncluttered room
- Wash basin
- Easily cleaned surfaces
- Places for instruments
- All equipment should be movable for cleaning
- Temperature and ventilation

Floor

- Floor should be:
- Smooth
- Seamless
- Non-porous
- Constructed of fireproof materials

Walls

- Walls- should be:
- Hard
- Non-porous
- Fire Resistant
- Stain proof
- Seamless
- Easy to clean

Floor & Walls

Doors

- Doors- Surface-sliding type
  (not recessed into the wall)

To eliminate air turbulence caused by swinging doors and allows all surfaces to be washed

Doors

Operating Table

- Simple standard couch
- Height adjustment
- Operating on the head and neck
- It may be moved out during cleaning
- It can be fixed into the floor with removable top sections to permit the different positions of the patient

The Goals of the Ventilation System

1. Comfort of the patient in the OR
2. Comfort of surgeons /personnel in the OR
3. Control of the concentration of pollutants:
   - Chemical (anesthetic gases/volatile substances)
   - Physical (particulates/aerosols)
4. Ability to quickly raise or lower the temperature
5. Control of infections (microbiological pollutants)
6. To control humidity and suppress the build-up of static electricity

Various Components of Ventilation Systems in the OR

1. Ventilation
2. Heating and cooling
3. Humidity control
4. Waste anesthetic gas scavenging

Heating, Ventilation, Air-conditioning system: HVAC

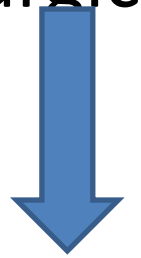
Parameters for OR

Parameters	Measures
Temperature	68-75ºF (20-24^{0}c), depending on normal ambient T.
Relative humidity	20%-60%
Air movement	Positive pressure, from “clean to less clean” areas
Air changes per hour	20
Exchange outdoor air per hour	4

FGI

Heating and Air Conditioning

- keeping patients warm during the perioperative period is highly beneficial.
- The comfort of the surgical team should be kept.



Heating and air conditioning systems
must allow the individual room T.
to be raised or lowered rapidly as needed.

Heating and Air Conditioning

T. change must be accomplished **without a large overshoot** in the desired T.

T. change can be accomplished with **individual "reheat coils"** in each OR.

Control of Temperature for OR

Recommended temperatures for ORs:

Between 68°F and 73°F (20-22ºC) during surgery

Between 62°F and 80°F (16.6-26.6ºC) otherwise

Between 70°F and 75°F (21-24ºC) for the post-anesthesia care unit (PACU)

Control of Temperature

- In a very large room, a thermostat controlling the air T. by measuring the air around a distant wall will not reflect the T. around the surgical table.

Care in how the room T. is measured

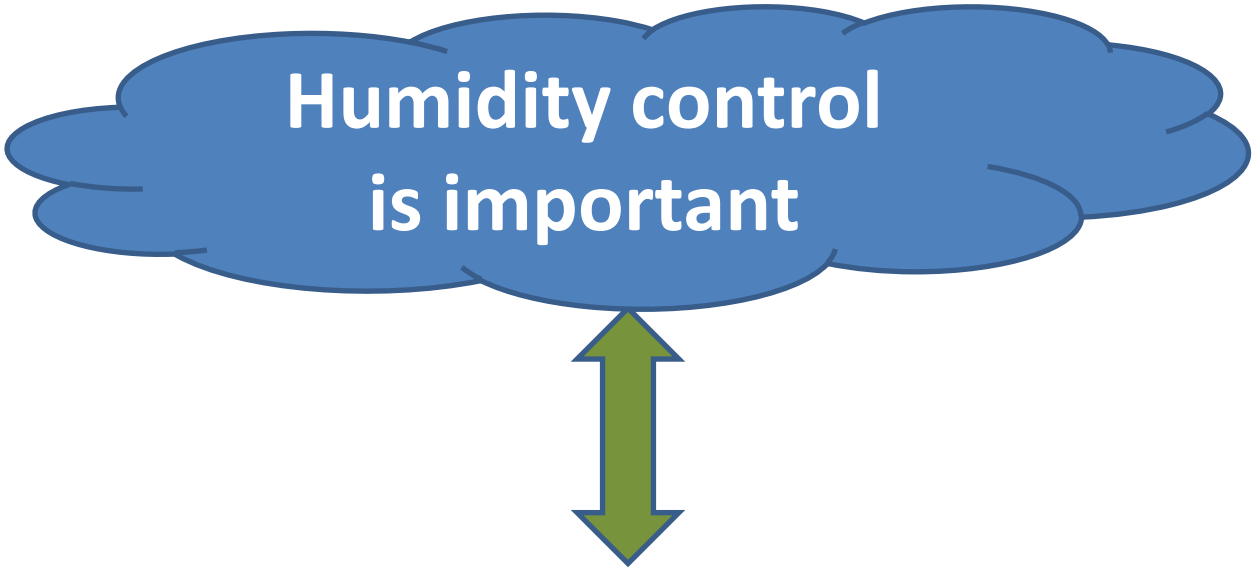
- **Placing the thermostat in the middle of the room**

Control of Temperature

- A move to LED surgical lights, which produce significantly less heat, may make the T. of the immediate surgical environment easier to control since it will more likely ref the environment further away from the patient.

- The use of devices to directly warm the patient also makes the room temperature less important, except when patient cooling is desired

Humidity Control



- Decreased humidity may lead to damage in the respiratory tract and loss of body heat through evaporation of sweat.
- Excessive humidity is also undesirable for patient and staff comfort

Humidity Control

- Long procedures
- Multiple-layered gowning
- X-ray protection

Surgeons are requesting lower temperatures in the OR.

These lower temperatures affect the moisture

Humidity Control

- Obtaining specified temperature and humidity conditions:

- A conditioning system with a tight single-point control thermostat and humidistat

- A thermostat and humidistat suitable for OR application; be sure that they are properly positioned and routinely calibrated.

Relative Humidity in ORs and PACU

- **30** - 60%

New recommendation

20 - 60%

Ventilation

- A ventilation system in the OR can be either a:
  - ♣ Recirculating
  - ♣ Non-recirculating system

Ventilation

- In a non-recirculating system, all air brought to the room is conditioned, outside air.

- A recirculating system is one that recirculates some or all of the inside air back to the OR suites or some other part of hospital.

- When a recirculating system is used, the air return duct should have a high efficiency particulate air (HEPA) filter built into the

Ventilation

- In an OR where inhalational anesthetics are used, **there should be separate systems for:**

❖**ventilation**

❖**vacuum** (patient and surgical suction)

❖**waste anesthetic gas disposal** (WAGD)

- A recirculating ventilation system in the OR can be a problem if a passive WAGD system is in use.

Ventilation

- In a passive WAGD system, waste anesthetic gas from the anesthesia machine is directed to the room ventilation return duct that removes air from the OR.

- In a recirculating ventilation system, this waste anesthetic gas will mix with fresh air inflow and be returned to the same room or other areas of the facility.

Ventilation

- Thus, **it is recommended not to use a passive** WAGD system in new construction, *and*
- If it is used, ventilation should be the non-recirculating type.

- **It is best to have a separate active WAGD system** that is independent of both the ventilation and vacuum systems, and gases from the WAGD system need to be exhausted

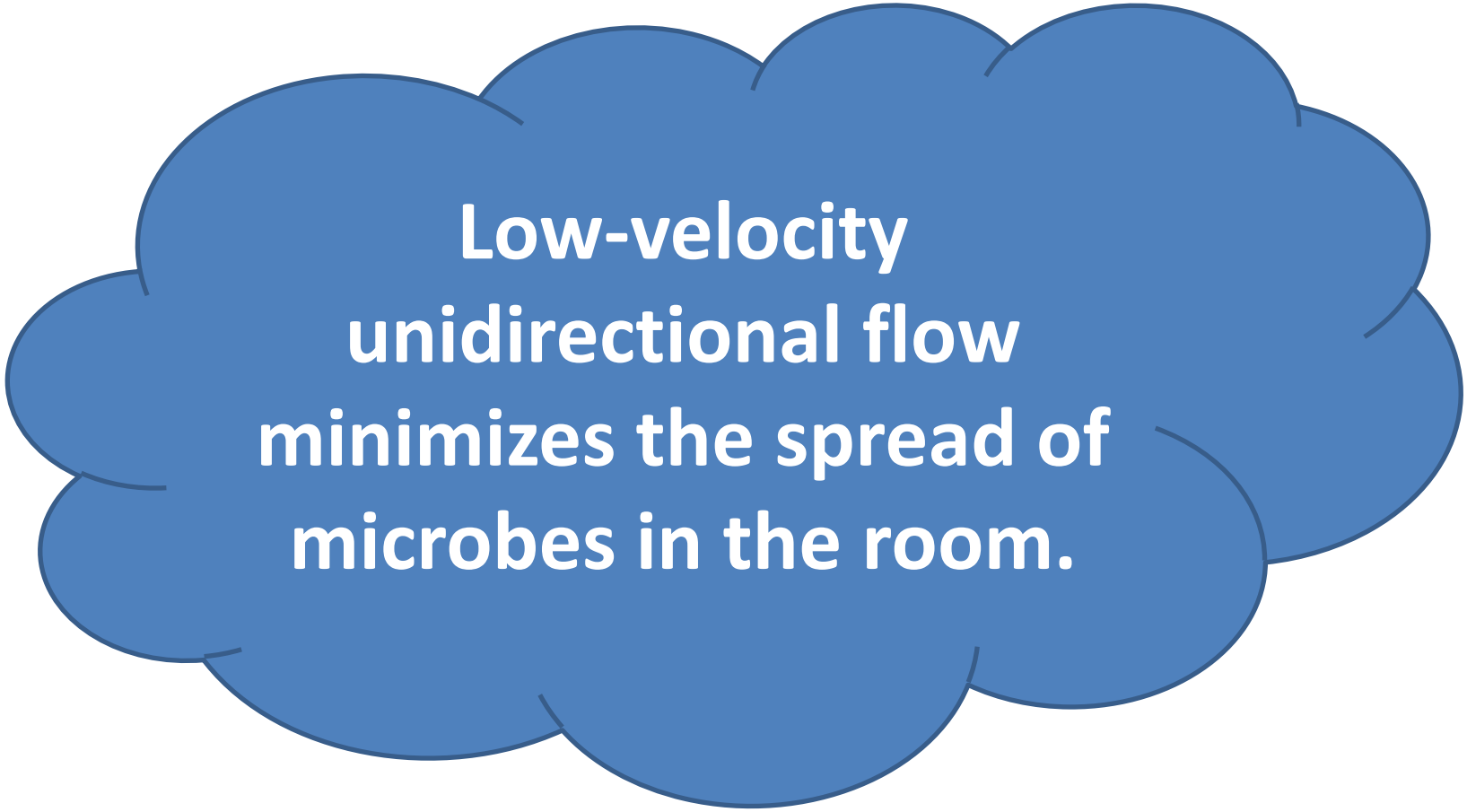
Main Types of Airflow Systems

- Turbulent-flow
- Unidirectional-flow
- Mixed-flow

Turbulent Flow

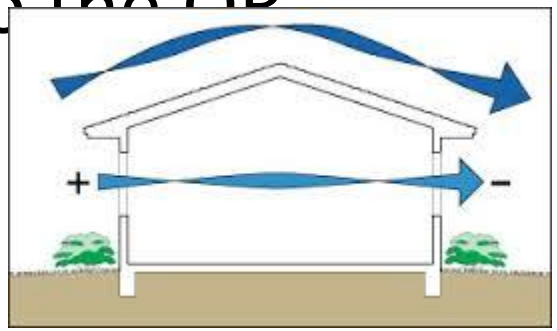
- Turbulent flow directly involves
  the whole environment,
  the concentration of airborne contaminants
  being controlled by means of dilution.

Directional Flow



Directional Flow

- Directional flow can be:
  - Inward, from the outside into the OR
    (Negative pressure)



  - Outward, from the OR to the outside
    (Positive pressure)

Directional Flow

Positive pressure ventilation: *for protective environments*
(**ORs/rooms** with **immunocompromised** pts)

Negative pressure ventilation:

for highly infective rooms in the hospital

(isolation rooms for TB patients)

Operating Room Ventilation, Laminar Airflow

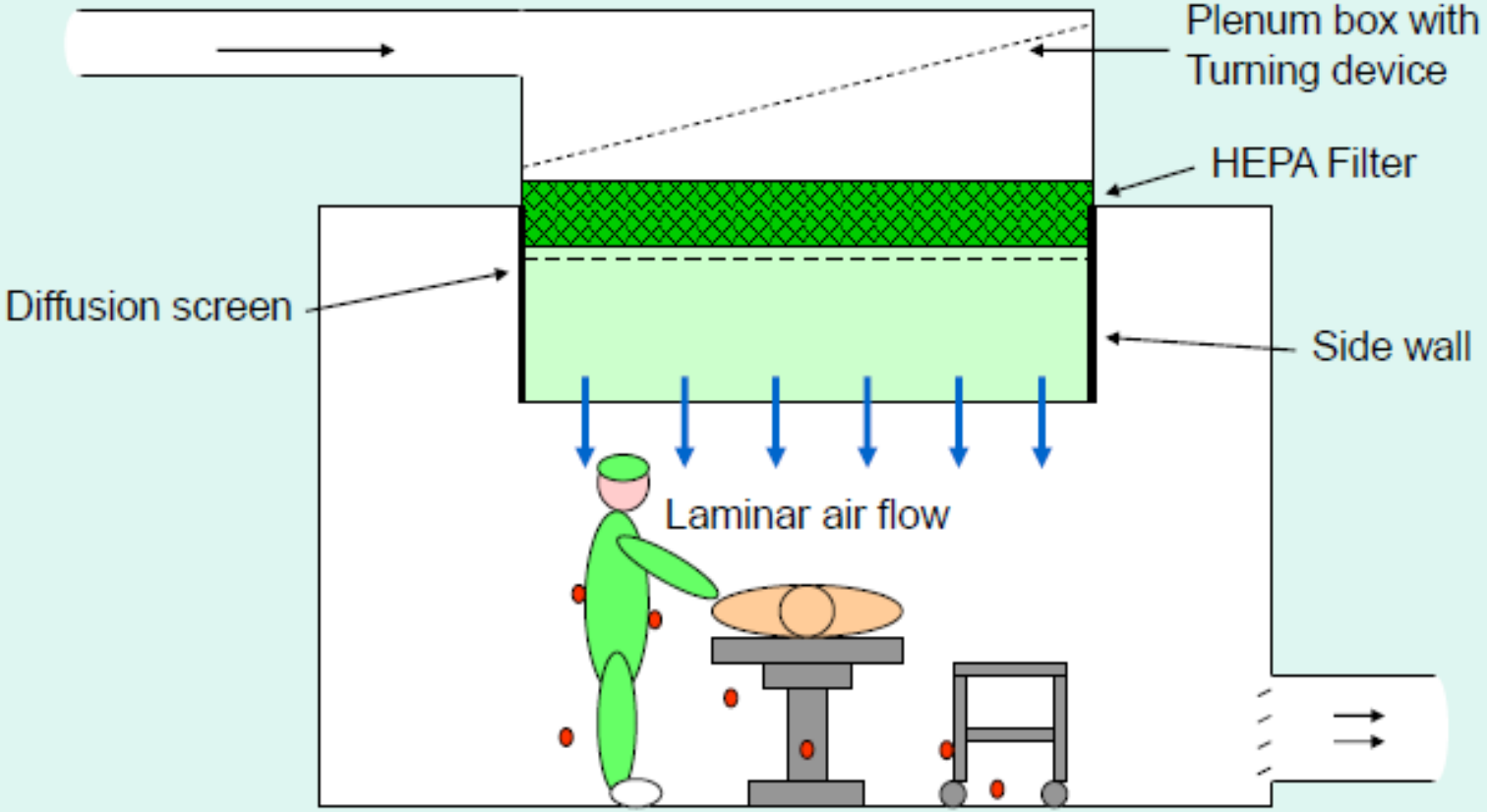
- To move particle-free air (“ultraclean air”) over the aseptic operating field at a uniform velocity (0.3 to 0.5 µm/sec)

- Can be directed vertically (ceiling-mounted) or horizontally (wall-mounted)

Laminar Airflow

- Recirculated air is usually passed through a high efficiency particulate air (HEPA) filters
- HEPA filters remove particles >0.3µm in diameter with an efficiency of 99.97%

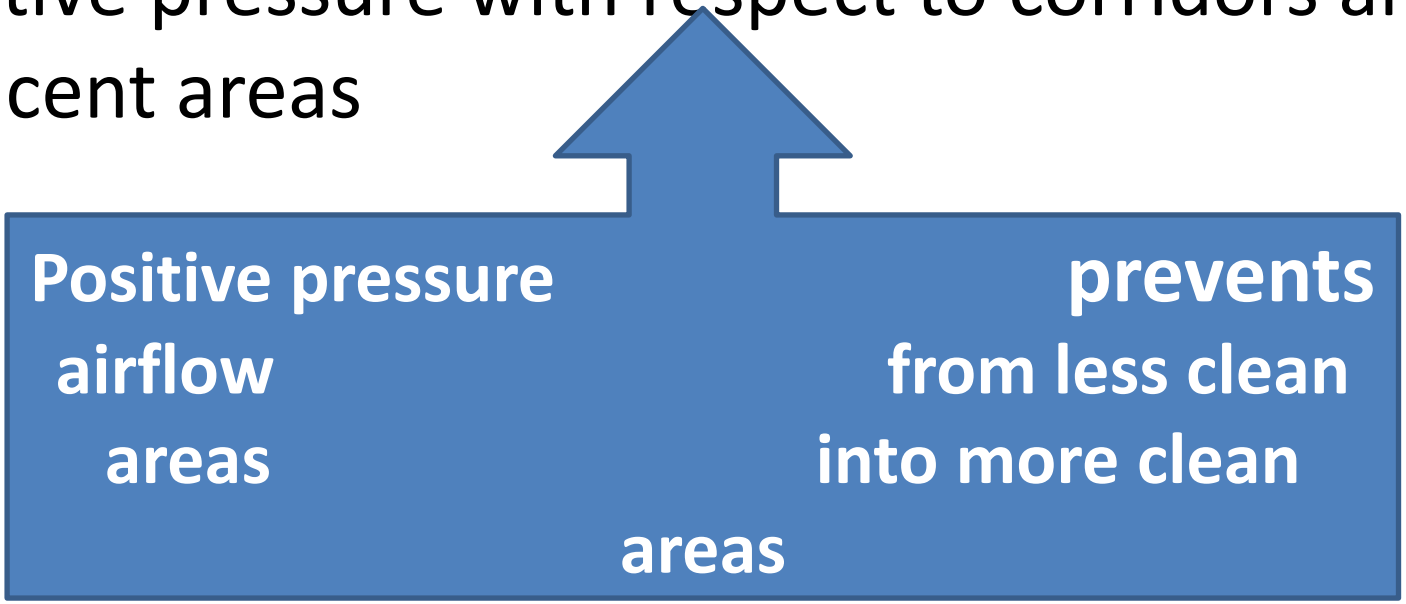
Downward displacement ventilation
Laminar flow



Air Movement

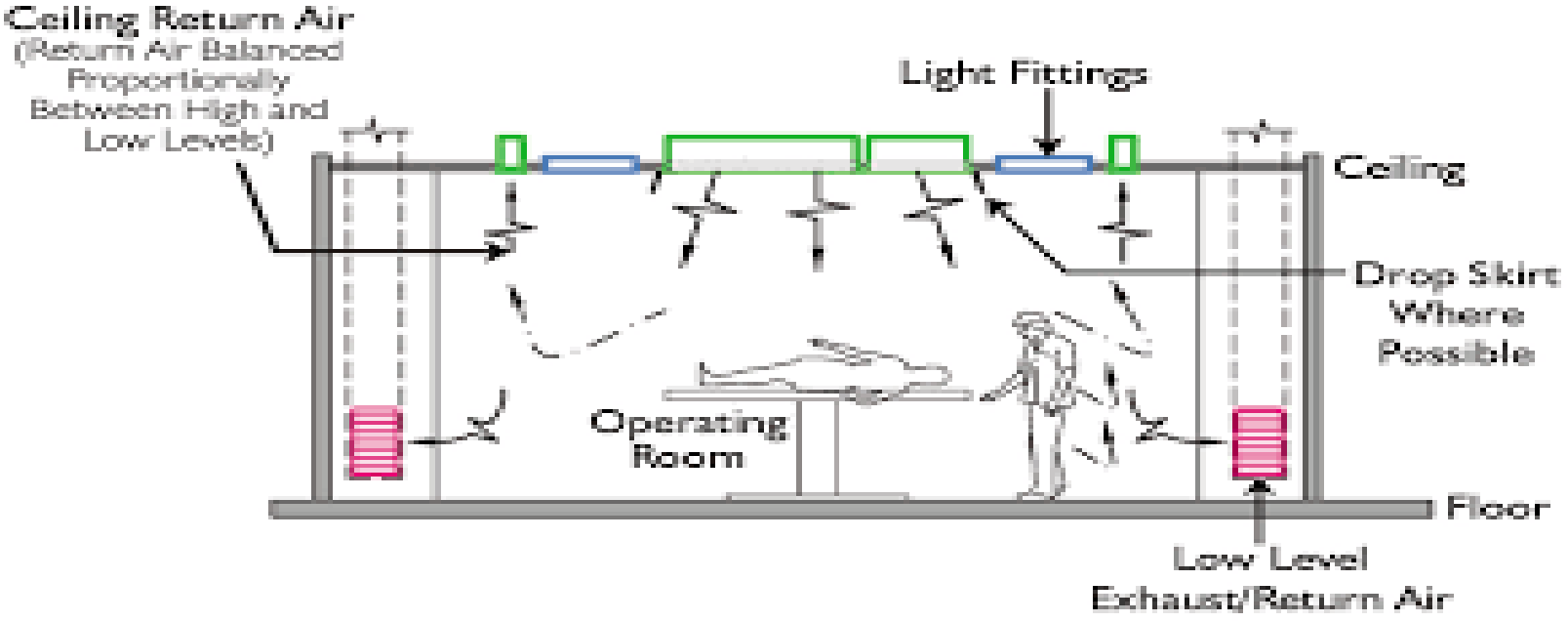
- *Ventilation*

Operating rooms should be maintained at positive pressure with respect to corridors and adjacent areas



Directional Flow

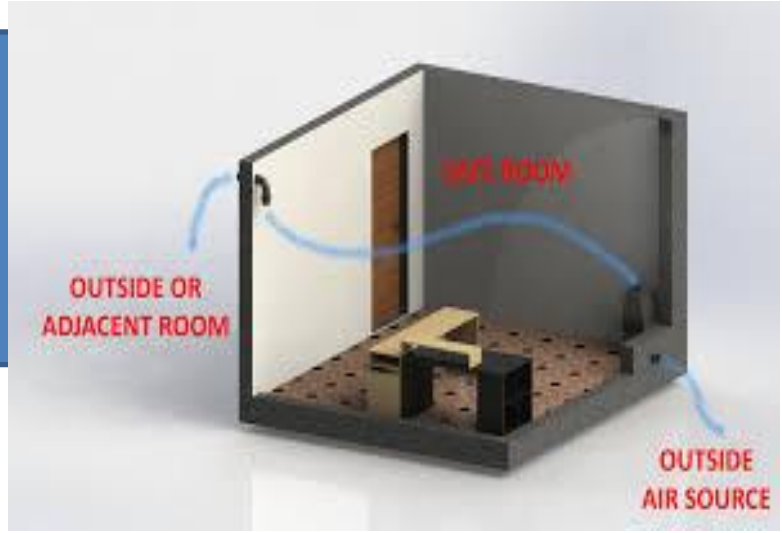
- **Positive-pressure ventilation** is used with a **minimum differential pressure of 2.5 Kpa** between the OR and the corridors.



Operating Room Environment

- Air should be:
  - ♣ Introduced at the ceiling to each OR
  - ♣ Exhausted near the floor or return ducts (downward movement)

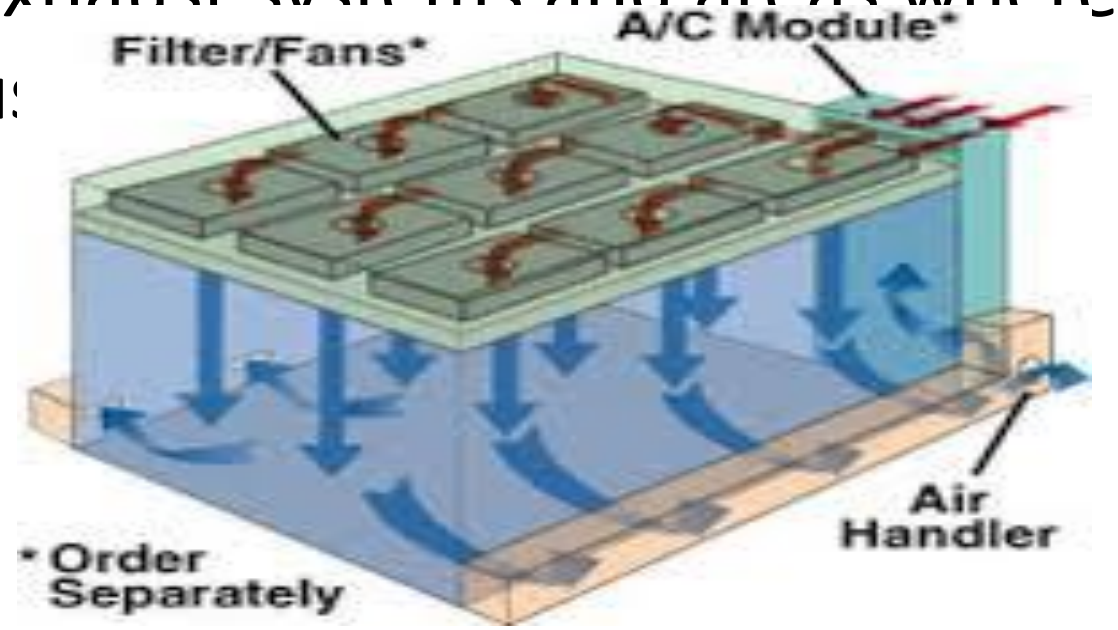
Steady movement of clean air through the breathing and working zones



Location of Outside Fresh Air Inlets (AIA)

To minimize contamination from exhaust systems and noxious fumes:

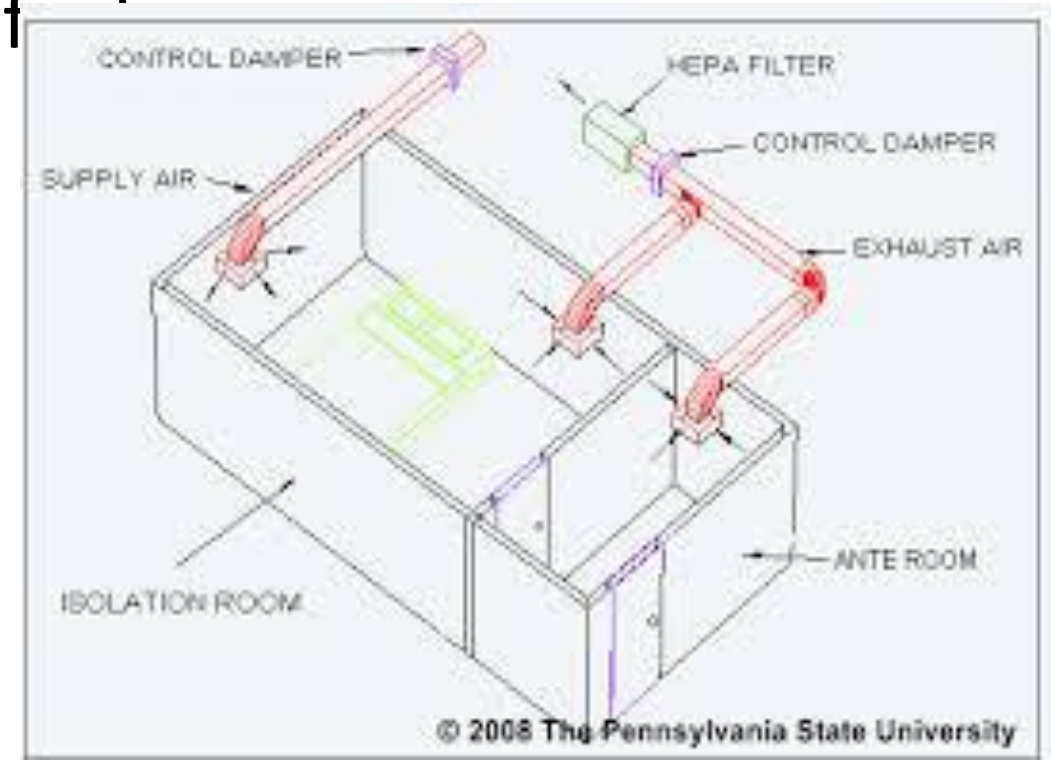
- Fresh-air intakes (for instance, on the roof) are to be located at least 25 feet (7.62 meters) from exhaust systems and areas where noxious



Location of Outside Fresh Air Inlets (AIA)

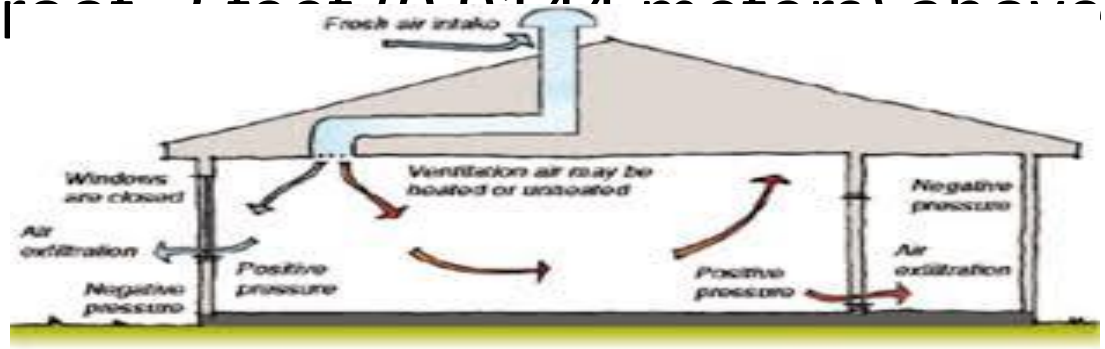
To minimize contamination from exhaust systems and noxious fumes:

- Plumbing vents may end as close as 10 f… (3.05 meters) to the air intake system.



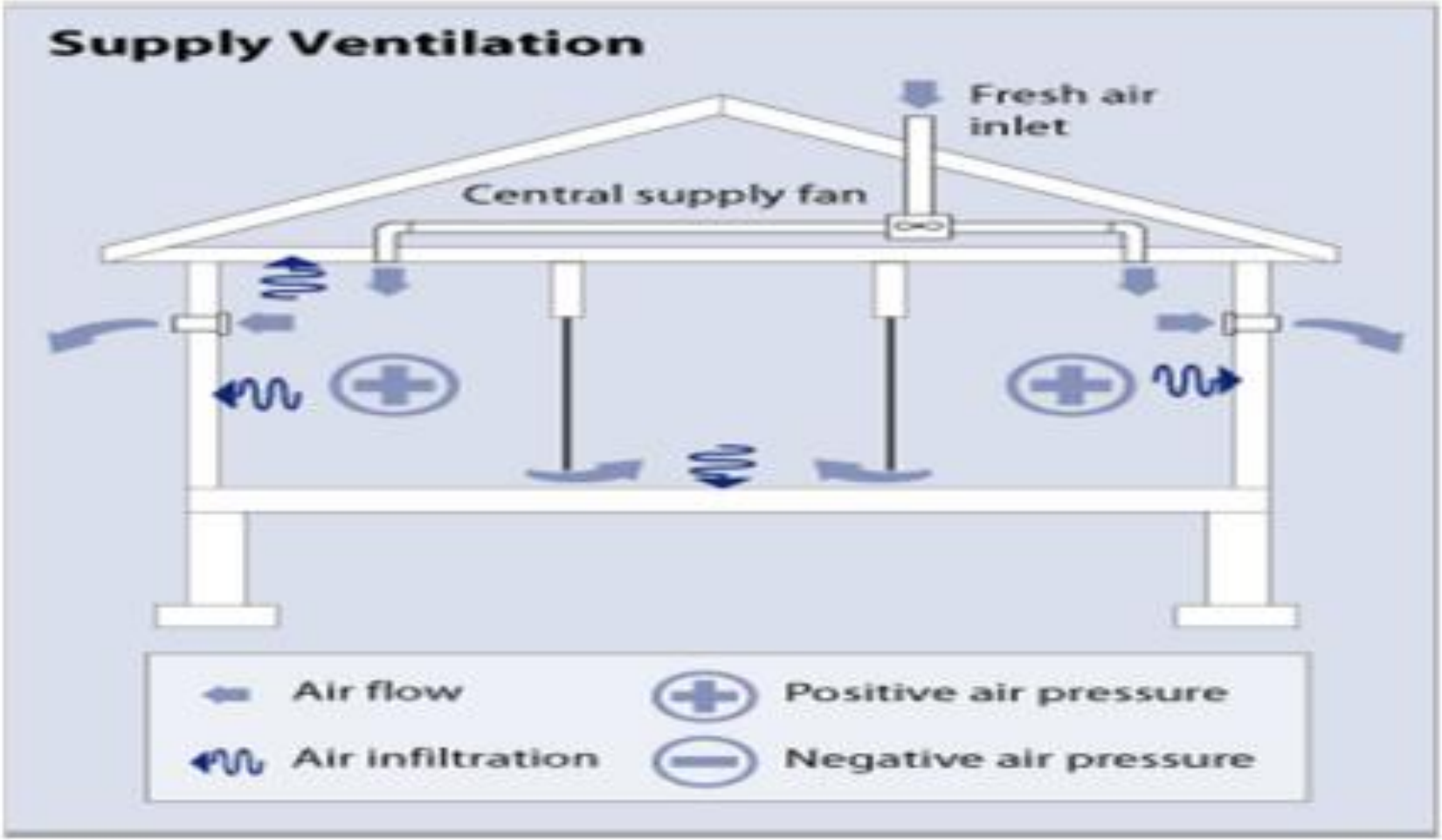
Directional Flow

- Outdoor-air intakes are to be as high as practical:
- with their bottoms at least 6 feet (1.83 meters) above ground level **or,**
- if on a roof, 3 feet (0.9144 meters) above roof level.



- Air that could otherwise be recirculated ("relief air") but is discharged to the outside to maintain building pressure is exempt from this separation

Ventilation System



Directional Flow

- A higher air inflow rate and a larger air-inlet area are desirable for contaminant control, but these approaches are detrimental to the thermal comfort of the staff and patient.

Operating Room, Air Changes per Hour

- Conventional operating room ventilation systems:

  Minimum 15 ACH

  Minimum 3 (20%) air changes of outdoor air per hour (fresh air)

- **New:** 20 ACH

  4 outdoor air

Air-change Rate in an OR (AIA)

- 20 to 25 ACH for:
- Ceiling heights between 9-13 feet (2.74- 3.66 meters)

- Providing a single-directional flow, with both high- and low-exhaust locations

Air-change Rate in an OR (AIA)

- A face velocity of around 25 to 35 fpm (0.13 to 0.18 m/s) from a non-aspirating diffuser array (i.e., ceiling air inlets)

- Provided that the array size itself is set correctly such that it covers at least the area footprint of the OR table plus a reasonable margin around it

Aír-change Rate in an OR

- And that if additional diffusers are required, they may be located outside this central-diffuser array.

- According to the AIA, up to 30% of the central-diffuser array may be allocated to non-diffuser items (e.g., medical gas columns, lights, and equipment booms.)

Operating Room Ventilation Systems

- Operating room ventilation systems should operate at all times, except during maintenance and conditions requiring shutdown by the building's fire alarm system.
- During unoccupied hours, air exchange can be reduced as long as positive pressure is maintained in each OR.
- Complete shutdown of the ventilation system may permit airflow from areas with less clean air into the relatively negative pressure area of

Laminar Airflow

- Most operating theatres have conventional ventilation and laminar air-flow systems with HEPA filters are generally used for orthopaedic **and** other implant surge

Laminar Airflow

- A meta-analysis encompassing 26 studies could not ultimately confirm the role of LAF in surgery, and some recent studies have even indicated an increase in SSI after hip prosthesis with procedures performed under LAF.